increase of cholesterol levels. The oil holding capacity of the soybean residue treated by high pressure is improved, which may be caused by the change of the dietary fiber spatial structure during the high pressure treatment.

2. Effect of high pressure treatment and ultrafine grinding on the microstructure of soybean residue.

The sample was magnified 600 times and three different treatments were used for comparison by scanning electron microscopy. It was found that soybean residue sample became large piece after high pressure treated, its structure became more porous, the water was more easily infiltrated and absorbed, the structure became more loose, it makes more hydrophilic groups be exposed, thereby increasing the water holding capacity of the soybean residue. The particle size of the soybean residue treated by the ultrafine grinding is significantly smaller, the specific surface area is obviously increased, the porous network structure inside the soybean residue were damaged to various degrees due to the strong mechanical shearing action.

In general, the sample of soybean residue has improved water holding capacity, oil holding capacity and expansibility property processed by the high pressure technology compared to the ultrafine grinding treatment. The soybean residue particles became smaller and uniform, and the spatial structure disappears after the ultrafine grinding treatment, while the fibrous structure is looser after the high pressure treatment, and the spatial structure is partially retained.

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THE RHEOLOGICAL PROPERTIES OF PORK MEAT BATTERS, PRODUCED USING SOY PROTEIN ISOLATE AND PROCESSED BY HIGH PRESSURE

High pressure processing, a non-thermal technology, has been successfully applied on meat products for modifying meat proteins functionality. Soy protein isolate is a commonly useful vegetable protein in the meat industry, which has a good water and fat holding capacity, excellent gelling and structural behaviour. The objective of the present study was to evaluate the textual properties of pork meat batters produced

by high pressure combined with soy protein isolate, and find a method to produce pork meat batters with overall acceptability.

The chilled pork *longissimus dorsi* muscles (71.35±0.52% moisture, 22.57±0.37% protein, 2.83±0.26% fat; pH 5.63±0.02) (AOAC 2000) were derived from the landrace (100±5.0 kg). Pork back-fat (90.21±0.56% fat) was purchased from a local meat market (Xinxiang, China). Soy protein isolate (91.32±0.83% protein) was provided by Shandong Shansong Soy Foods co., Ltd (China).

Raw pork batters were prepared as follows. C: 400g pork meat, 80g pork back-fat, 70g ice water, 10g NaCl; T1: 400g pork meat, 80g pork back-fat, 70g ice water, 10g NaCl, 10g soy protein isolate (1%); T2: 400g pork meat, 80g pork back-fat, 70g ice water, 10g NaCl, 20g soy protein isolate (2%). The batters were produced according to standard technology and were vacuum packed for subsequent high pressure processing.

The vacuum packed batters were put into a high pressure vessel (S-FL-850-9-W/FPG5620YHL, Stansted Fluid Power Ltd., Stansted, UK), the water was used as pressure transmitting medium and it was adjusted to the desired temperature with circulating water from a thermo-stating circulator bath. The pork batters were treated under 200 MPa for 10 min at 10±2 ℃. All experiments were performed in triplicate. After high pressure processing, all samples were heated in a water bath at 80 ℃ for 30 min, then cooled immediately with running water and stored at 4 ℃ until analysis.

The texture profile analysis of cooked pork batters (the cylindrical-shaped with a diameter of 20 mm and a height of 20 mm) were performed using a texture analyzer (TA-XT 2i plus Texture analyzer, Stable Micro Systems, UK) with an aluminum cylindrical probe P/36R. Parameters as follow: test speed 2 mm/s, compression ratio 40%, trigger force 5 g, and 5 s was allowed between the double compression cycle test. The indicators of hardness, springiness, cohesiveness and chewiness were determined. Five replicates were performed for each treatment group. The data was expressed as mean ± SD and analyzed using the one-way ANOVA program ($p<0.05$) (Table).

Table

Texture profile analysis of cooked pork batters produced by different soy protein isolate combined with high pressure processing

Sample	Hardness (N)	Springiness	Cohesiveness	Chewiness (N mm)
C	47.32 ± 1.12^{c}	0.837 ± 0.008^{b}	0.641 ± 0.005^{c}	27.05 ± 0.85^{c}
T1	53.21 ± 0.98^{a}	0.863 ± 0.009^{a}	0.687 ± 0.007^{a}	35.68 ± 0.89^{a}
T2	50.42 ± 1.05^{b}	0.835 ± 0.007^{b}	0.655 ± 0.008^{b}	29.67 ± 0.96^{b}

C: with pork back-fat; T1: 2% soy protein isolate; T2: 4% soy protein isolate. [a-c] Different parameter superscripts in the figure indicate significant differences ($p < 0.05$).

The result showed that the hardness and springiness was significantly ($p < 0.05$) increased when added 2% soy protein isolate, but they were significantly ($p < 0.05$) decreased when added 4% soy protein isolate. Overall, the addition of 2% soy protein isolate combined with high pressure processing are able to produce the pork meat batter with textural properties.

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ADVANCES IN RESEARCH ON ANTIOXIDANT ACTIVITY OF TANNIC ACID

Tannic acid, is a polyphenolic compound found in plant tissues such as persimmon, tea, coffee, pomegranate, and sorghum. The structure of tannic acid is very complex and belongs to polyhydroxyphenols compound. Tannins are also associated with astringency in foods and feeds. Moreover, tannic acid can form a precipitate in combination with proteins, alkaloids, pectin, etc., and has therefore been considered as an anti-nutritional factor in feed (Pan Xiancai et al. 2013), this may be related to the ability of tannic acid to interact with digestive enzymes in animals, but this anti-nutrition can only be the result of certain tannins at high doses. While at low doses, tannins have a positive effect on the nutrition and health of the animal. A large number of studies in recent years have shown that tannins have many benefits for human health. Tannin has a variety of biological activities, including anti-oxidation, cardiovascular protection, anti-inflammatory, anti-cancer, anti-viral, anti-bacterial, and improve intestinal micro-ecological environment. The various health effects have been documented in recent years by using synthetic antioxidants (Shahidi, Janita, Wanasundara, 1992). There are growing concern on exploiting natural antioxidants due to their safety, consumer acceptability. This article focuses on the antioxidant activity of tannic acid and its application prospects in extending the shelf life of foods.

Tannic acid has strong in vitro antioxidant activity. The phenolic hydroxyl group itself has strong reducibility and is also the main active group of tannins. Therefore, tannins possess potent antioxidant activities